WHAT IS CLAIMED IS:

1. A magnetoresistive element, comprising:

an intermediate layer; and

a pair of magnetic layers sandwiching the intermediate layer;

wherein one of the magnetic layers is a pinned magnetic layer in which magnetization rotation with respect to an external magnetic field is harder than in the other magnetic layer;

wherein the pinned magnetic layer includes at least one non-magnetic film and magnetic films sandwiching the non-magnetic film; and

wherein the magnetic films are magnetostatically coupled to one another via the non-magnetic film.

2. The magneto-resistive element according to claim 1, wherein an element area, which is the area of the intermediate layer in a plane perpendicular to the direction in which current flows, is not more than 10 μm^2.

3. The magneto-resistive element according to claim 1, wherein at least one of the magnetic films has a coercivity of at least 500 Oe.

4. The magneto-resistive element according to claim 1, further comprising an antiferromagnetic layer, which is magnetically coupled with the pinned magnetic layer.

5. The magneto-resistive element according to claim 1, wherein the intermediate layer is made of a semiconductor or an insulator and includes at least one element selected from oxygen, nitrogen, carbon and boron.

6. The magneto-resistive element according to claim 1, wherein the intermediate layer is made of a conductive material including a transition metal.

7. The magneto-resistive element according to claim 6, wherein the element area, which is the area of the intermediate layer in a plane perpendicular to the direction in which current flows, is not larger than 0.1 μm^2.

8. A magnetoresistive element, comprising:

an intermediate layer; and

a pair of magnetic layers sandwiching the intermediate layer;

wherein one of the magnetic layers is a pinned magnetic layer in which magnetization rotation with respect to an external magnetic field is harder than in the other magnetic layer;

wherein the pinned magnetic layer includes at least one non-magnetic film and magnetic films sandwiching the non-magnetic film;

wherein the magnetic films are coupled to one another by magnetostatic or antiferromagnetic coupling via the non-magnetic film; and

when the magnetic films are magnetic films that are arranged at positions m (with m being an integer of 1 or greater) from the intermediate layer, Mm is an average saturation magnetization of the magnetic films m and dm is their respective average film thickness, Mdo is the sum of the products Mm×dm of the magnetic films with odd m and Mde is the sum of the products Mm×dm of the magnetic films with even m, then

$0.5 < Mde/Mdo < 1$.

9. The magneto-resistive element according to claim 8, wherein an absolute value of a magnetic field shift of said other magnetic layer that is a free magnetic layer is not more than 50% of a coercivity of the free magnetic layer,

where the magnetic field shift is given by the equation

$s = (H_1 + H_2)/2$,

wherein H_1 and H_2 (with $H_1 > H_2$) are two magnetic fields at which magnetization becomes zero ($M = 0$) in a magnetization-magnetic field curve (M-H curve) showing the relationship between magnetic field (H) and magnetization (M).

10. The magneto-resistive element according to claim 8, wherein at least one of the magnetic films has a coercivity of at least 500 Oe.

11. The magneto-resistive element according to claim 8, further comprising an antiferromagnetic layer, which is magnetically coupled with the pinned magnetic layer.

12. The magneto-resistive element according to claim 8, wherein the intermediate layer is made of a semiconductor or an insulator and includes at least one element selected from oxygen, nitrogen, carbon and boron.

13. The magneto-resistive element according to claim 8, wherein the intermediate layer is made of a conductive material including a transition metal.

14. The magneto-resistive element according to claim 13, wherein the element area, which is the area of the intermediate layer in a plane perpendicular to the direction in which current flows, is not larger than 0.1 μm^2.

15. A magnetoresistive element, comprising:

an intermediate layer; and

a pair of magnetic layers sandwiching the intermediate layer;

wherein at least one of the magnetic layers includes an oxide ferrite having a plane orientation with a (100), (110) or (111) plane; and

wherein a change in electric resistance is detected by introducing an external magnetic field in said plane.

16. The magneto-resistive element according to claim 15, wherein the external magnetic field is introduced in a direction of the axis of easy magnetization in said plane.

17. The magneto-resistive element according to claim 16, wherein the oxide ferrite is oriented in the (110) plane, and, taking the direction of the <100> axis in that plane as 0°, the external magnetic field is introduced at an angle in a range of at least 30° and at most 150° in that (110) plane.

18. The magneto-resistive element according to claim 16, wherein the oxide ferrite is oriented in the (100) plane, and, taking the direction of the <100> axis in that plane as 0°, the external magnetic field is introduced at an angle in a range of at least 40° and at most 50° or at least 130° and at most 140° in that (100) plane.

19. The magneto-resistive element according to claim 16, wherein the

oxide ferrite is aligned in the (111) plane and the external magnetic field is introduced in that (111) plane.

20. The magneto-resistive element according to claim 15, wherein the oxide ferrite is non-orientated in said plane.

21. The magneto-resistive element according to claim 15, wherein the oxide ferrite is magnetite.

22. The magneto-resistive element according to claim 15, wherein the intermediate layer is made of a semiconductor or an insulator and includes at least one element selected from oxygen, nitrogen, carbon and boron.

23. The magneto-resistive element according to claim 15, wherein the intermediate layer is made of a conductive material including a transition metal.

24. The magneto-resistive element according to claim 23, wherein the element area, which is the area of the intermediate layer in a plane perpendicular to the direction in which current flows, is not larger than 0.1 μm^2.

25. A method for manufacturing a magnetoresistive element comprising an intermediate layer and a pair of magnetic layers sandwiching the intermediate layer, wherein at least one of the magnetic layers includes an oxide ferrite; the method comprising:

forming the oxide ferrite by sputtering with an oxide target while applying a bias voltage to a substrate including a plane on which the oxide ferrite is to be formed so as to adjust an amount of oxygen supplied to the oxide ferrite from the oxide target.

26. The method for manufacturing a magneto-resistive element according to claim 25, wherein the applied bias voltage is a high-frequency bias voltage.

27. The method for manufacturing a magneto-resistive element according to claim 25, wherein the substrate temperature is at least 250°C

and at most 700°C.

28. A method for forming a magnetic compound film, the method comprising:

forming the magnetic compound film by sputtering with a compound target while applying a bias voltage to a substrate including a plane on which the magnetic compound film is to be formed so as to adjust the amount of at least one selected from oxygen and nitrogen supplied to the magnetic compound film from the compound target.

29. The method for forming a magnetic compound film according to claim 28, wherein the applied bias voltage is a high-frequency bias voltage.

30. The method for forming a magnetic compound film according to claim 28, wherein the substrate temperature is at least 250°C and at most 700°C.